SUPPLY VS. DEMAND AS A TOOL FOR RECRUITMENT OF U. S. NAVAL OFFICERS

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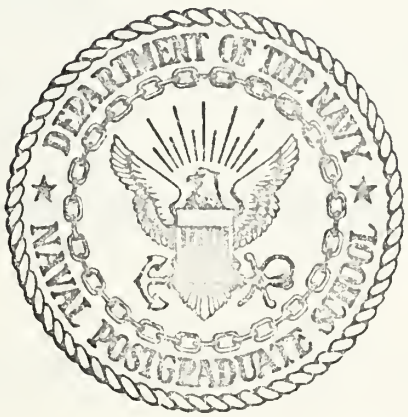

THESIS

SUPPLY VS. DEMAND AS A TOOL FOR
RECRUITMENT OF U.S. NAVAL OFFICERS

by

Charles Daniel Shields, Jr.

March 1975

Thesis Advisor: J.K. Arima

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Supply vs. Demand as a Tool for Recruitment of U.S. Naval Officers

by

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PREFACE

In his Annual Defense Department Report for FY1974, the Secretary of Defense, Elliott L. Richardson, stated that "By 1974, requirements for new commissioned officers will drop to about 20,000 per year, excluding medical officers. Attracting this number from the 280,000 qualified men who will graduate from colleges should not be a difficult task."[1] Statistics concerning officer recruiting through fiscal year 1974 make it easy to understand why such an attitude exists at the highest level of personnel management in the Department of Defense. The prospect for officer recruiting in the future is a worthwhile subject for careful analysis, however. In the U.S. Navy, as in other services, there is a need to project requirements into a potential environment which has never before existed. Specifically, the future of the United States could easily consist of an antimilitary society, a no-draft environment, and a solid economic outlook which will encourage the individual college graduate to seek employment in the private sector. A method is addressed in this study to assist in determining whether future Secretaries of Defense will be able to feel as confident as the Honorable Mr. Richardson did in FY1974 concerning officer recruiting.

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[1]Ref. 10, p. 104

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1. INTRODUCTION

1.1. General

A long-range officer recruiting model of the U.S. Navy is best constructed by comparing supply, the total population of qualified and potentially interested college graduates, with demand, and forecasted needs of the U.S. Navy. Such a method can only be as successful as the accuracy of the statistical estimates of supply and demand which are used to construct the model. An accurate model can be used to predict not only the degree of difficulty officer recruiters will encounter in achieving their various goals, but also the optimal mix of candidates the Navy assists financially through college or postgraduate education versus candidates who enter the service after paying for their own education. Externalities exist in the study of this mix, and only at the highest levels of U.S. Navy personnel management can these be given proper weight. For example, how much better a product is produced by NROTC than by Officer Candidate School? Can we insist on chaplains possessing a degree in psychology and still achieve our recruiting goal? Can we change the percentage of line officers who are women from the present 6% to 30%? It is highly desirable that a model be developed as rapidly as possible to assist decision makers in answering such questions.

1.2. Background

There have been radical changes over very recent years which have placed added emphasis on recruiting. With recent pay increases and hardware cutbacks, manpower costs now represent 56% of total funds available to DOD.[2] The draft has been terminated. The attitude of our society has become decidedly more antimilitary. Fortunately, these factors thus far have not coincided with a prosperous economic outlook, which would provide even more encouragement to the individual to join the private sector instead of opting for military service.

A dramatic effort has been underway since 1970 to develop a dynamic recruiting force, capable and aggressive enough to negate the potentially disastrous factors listed above. Historically, officer recruiting in the U.S. Navy has not been as much of a problem as enlisted recruiting and consequently most of the emphasis has been devoted to enlisting the sailor. At the present time, efforts are progressing to accumulate data on both enlisted and officer programs, and to store data in the computer databank at U.S. Naval Recruit Command Headquarters in Washington, D.C. for future use.

The Navy recognizes the need for the highest quality individuals to serve in recruiting jobs. The Navy also realizes the value of using statistical techniques to arrive

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[2] Ref. 10, page 97.

at solutions to complex problems. Why else would highly paid officers be sent for statistical training to such places as the U.S. Naval Postgraduate School, Monterey, California? Recently, a great deal of evidence[3] tends to show a need for the career personnel management officer, a highly trained individual whose total career in the Navy will be spent managing personnel. To this kind of individual, numbers such as projected accession strengths of a five-year defense plan, can be meaningful planning tools, numbers which can be intelligently utilized for long-range planning. At the present time, no such personnel management staff corps exists, but efforts are currently underway to establish such a program. Cdr. Richard Powers of the Office of the Assistant Secretary of Defense for Manpower, PA&E, has appealed very ably and convincingly for such a program, and has expended great effort attempting to implement such a program.

In 1969, A Study of Aviation Officer Procurement (Ref. 3) was conducted by the Bureau of Naval Personnel, Assistant Chief for Plans and Programs. This study recognized the no-draft environment in which the recruiter of the 70's has to work and attempted to study the recruiting problem as it pertained to the recruiting of officers with designator 13xx. In 1974, a study was conducted at OASD which was used to

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[3]Such as cost overruns on PCS orders in recent years.

impress Congress with the fact that the military had to recruit yearly one of every four graduates of medical school to achieve its recruiting goals. The uncovering of this fact was instrumental in obtaining approval of the $13,500 doctor bonus which has recently been instituted. While these studies were excellent and served their purpose well, they seem to have been crisis generated and not the result of long-range personnel planning by a team of experts.

All this preamble is necessary to construct a case for the fundamental idea behind this study. A few highly motivated, top quality officers, trained in statistics and personnel management techniques, will be of great value to the Navy if they are made responsible for initiating a model of the officer recruiting program, updating and improving estimates on a continuous basis, and refining the model as their data base becomes larger and more reliable. Informal liaiason with the Naval Recruiting Command Headquarters, Code 20 and Code 30, and with BUPERS (Pers 2) indicates that no such model currently exists, or at least none is known to exist by those who would benefit most from it. This study attempts to detail the information which should be placed into such a model. This study was developed through liaison with Recruiting Districts, Recruit Command Headquarters and Pers 2 at the Bureau of Naval Personnel. It should be scrutinized carefully at both the Bureau of Naval Personnel and the Naval Recruiting Command Headquarters prior to being utilized.

The Naval Academy has developed an interesting recruiting model. The Dean of Admissions is able to state, "As long as we have over 7,000 candidates we are assured of excellent selectivity and a good reserve in the event that our very stable rate of declination of appointments should suddenly increase."[4] Since the Academy recruits under a very controlled set of circumstances it is not surprising that it has been able to construct this model. How different is the USNA recruiting program from the program of the U.S. Naval Recruiting Command, which recruits for most officer programs except USNA? The Naval Academy's Candidate Guidance Office answers inquiries from around the country. The responses to these inquiries contain a preliminary questionnaire to confirm eligibility. Next, each eligible candidate is contacted by the nearest one of over 1,500 Blue and Gold Officers or Blue and Gold Affiliates to counsel and advise the candidate. In 1973 and 1974 about 30,000 young men asked for information. Eventually 7,123 candidates obtained at least one nomination and took medical examinations and physical dexterity tests for entrance to the USNA Class of 1978. Of these young men, 1,513 were ultimately accepted. A serious recruiting effort is undertaken six years prior to graduation of a particular USNA class.

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[4]Ref. 9, page 20.

On the other hand, the Naval Recruiting Command does not have one focal point for answering all inquiries. Some advertising is done locally, and some is done nationally. Some recruiters know exactly how many advertisements have been answered, and some do not. Some advertisements require preliminary information to confirm eligibility, and some do not. Preliminary data already available show that following up a response to an advertisement by a candidate who has supplied data to confirm eligibility yields a very high, success-to-failure ratio for recruiters, much higher than setting up a recruiting booth on campus, for example. Just how successful will advertising be when it evolves into an established method, with one standard form which confirms initial eligibility? Only a strong effort to gather accurate data and carefully tally them will answer that question.

The Naval Academy enjoys a ratio of almost twenty initial inquiries and 4.71 qualified candidates for every one selectee. Obviously, many other officer programs do not now, nor will they ever, enjoy this kind of selection ratio. Programs that do not will require special incentives and very hard work on the part of recruiters to achieve their goals of recruiting individuals of acceptable quality. Naval Academy recruiters have only one program to sell, and it is a good one, that is well known and widely respected. Recruiters have 65 active duty programs to sell, and many of them are relatively unknown and not as highly respected by some quarters of our society.

The USNA is a free college education. Many other programs are not. However, both models are basically the same. They have advertising, recruiters, screening physicals and National Agency Checks (NAC's). They both have excellent people doing the recruiting. They both recruit from a finite population which can be identified, sought out, and analyzed, given enough time. Since officers in the U.S. Navy are recruiting officers, the data which are gathered should be very reliable, hence very useful in rapid development of a workable data base.

SUPPLY	DEMAND
↓	↓
Total graduates	Projected requirements
(loss)	
Current year graduates	Selected applicants completing commissioning requirements
	(increment program source failures)
Screen for age	Selected applicants
(loss)	
Screen physical	(increment program selection failures)
(loss)	Qualified applicants
Screen NAC	(increment program qualification failures)
(loss)	
Screen special academic requirements	Total applicants
(loss)	(loss)
Screen OAR	Current year applicants
(loss)	
↓	↓
SUPPLY OUTPUT	DEMAND OUTPUT

FIGURE 1. Model for Obtaining Supply and Demand Outputs Used in Determination of Acquisition Ratio

$$\text{DEMAND OUTPUT from Figure 1} = \text{SUPPLY OUTPUT from Figure 1} \cdot \text{percentage potentially interested} \cdot \text{percentage contacted by recruiter}$$

$$\text{ACQUISITION RATIO} = \frac{\text{SUPPLY OUTPUT}}{\text{DEMAND OUTPUT}} = \frac{\text{qualified candidates}}{\text{each required commission}}$$

$$(\text{ACQUISITION RATIO})^{-1} = \frac{\text{DEMAND OUTPUT}}{\text{SUPPLY OUTPUT}} = \text{percentage potentially interested} \cdot \text{percentage contacted by recruiter}$$

FIGURE 2. Model for Determination of Acquisition Ratio

2. THE MODEL

2.1 A GENERAL DESCRIPTION

The flow diagram of a model which was developed to analyze the supply of available qualified candidates compared to the demand for candidates required by the U.S. Navy, based on projected requirements, is shown in Figures 1 and 2. The ratio of supply to demand, which is called acquisition ratio in the model, provides an approximation of the percentage of the qualified supply available which must be contacted by the recruiting force and which must be potentially interested in a Navy career in order for recruiting goals to be achieved. The different combinations of those potentially interested in a Navy commission and the recruiter contact efficiency which will produce the desired result can then be considered. This is quite helpful since interest level is so difficult to estimate empirically. One author attempted to estimate it by the opinion of parents, but his evaluation was imprecise at best.[5]

The supply available submodel starts with the total number of graduates in the population qualified for a given program. This number is then reduced to current year graduates, since that group provides the NROTC input and most of the OCS, AOC, and other inputs to the Navy. Estimates for current year graduates are easily obtained from Reference 8. This

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[5]Ref. 2, page 28.

population is further reduced by a series of loss operators: age, physical exam, National Agency Check (NAC), special academic requirements, and Officer Aptitude Rating (OAR).

The demand for candidates submodel starts with projected accessions required and increases the required pool through a series of operators, based on empirical estimates for previous failure rates for candidates attempting to qualify for commissioning. These operators are: program source failures, program selection failures, and program qualification failures. Total applicants is reduced to applicants from current year so that acquisition ratio can compare supply and demand for the same population, current graduates eligible for a given program.

On the supply side, the model can be used to determine impact of changes to age, physical, NAC, and OAR requirements, since such changes would directly affect the numerator of the acqusition ratio. Also, the model can accomplish a sensitivity analysis on a wide range of values for a particular operator.

On the demand side, the model can be used rapidly to analyze the potential effect of large errors in estimates of projected requirements, to assess impact of sudden and dramatic changes in percentage of applicants qualifying for a program or percentage of applicants from current graduating class, or percentage of qualified candidates declining selection.

In general, the model can be used to identify potential recruiting shortages in a timely manner, and to pinpoint areas requiring specific cost-benefit analysis.

2.2 THE SUPPLY SUBMODEL

The supply submodel applies a series of operators that decrement the supply available. These are: age, physical exam, NAC, special academic requirements, and OAR.

The age operator reflects the age limits that are specified in the officer recruiting programs for various specialties. The age limits specified are usually (but not always) modifiable to the extent of prior military service possessed by the applicant. Once the age limits are defined, the population of current graduates is reduced by the number of persons falling outside the age limits. Age is a restrictive factor within the control of the decision maker establishing the program. Of course, it is necessary to analyze several factors in establishing age limits, such as degree of maturity, total expected years of useful service, etc. It is desired to develop a method of obtaining a useful estimator for the operator screen age, given an age requirement. That is, given that aviation candidates must be 19-27½ years of age, what percent of current-year college graduates are ineligible due to age? This estimate can be obtained with a precision of plus-or-minus 5 percent using a random sample of 664 candidates. The derivation of this value for sample size is contained in Section 4.2. Care must be exercised to obtain

a truly random sample. Use of these random sample methods can assist a decision maker in assessing impact of a proposed age limit change.

The physical examination operator reflects the physical standards that are established in Navy regulations for commissioning in general and for special programs. All candidates for commissions must be able to pass a physical examination and candidates for very physically demanding programs, such as pilot or flight officer programs, must pass a more rigid physical exam than the standard one. Examples of items included in the pilot physical, but not in the standard physical are color blindness test, depth perception test, and a more strict hearing tolerance. This operator can best be obtained by insuring that all individuals who are interested enough in a program to take a physical examination are entered into the databank at Recruit Command headquarters with a simple pass or fail entry. At the present time, it seems a person who fails for some reason may or may not remain in the databank, whereas all individuals who pass the physical remain in the system. This distorts data so that useful estimates of percent passing physicals are impossible to retrieve from the databank. Reliable, easily accessible estimates for each program, based on actual data can be obtained if the data are not distorted.

The screen NAC operator reflects the background investigation (National Agency Check) which must be conducted prior to commissioning. A standard procedure is followed by

officials of the Federal Bureau of Investigation, or other such agency, to investigate the background of an individual for signs of moral turpitude, allegiance to foreign governments,or other reasons which might cause him to be labeled a security risk. Screen NAC has a special constraint in light of recent complaints that Americans are subject to too much "blacklisting" by computers. Therefore, it would be wise to program the computer only to count the total number of people rejected by NAC for each designator. In this way, the total percent rejected could be determined without storing controversial information concerning individuals. Again, it is important that the databank is not automatically programmed to erase an individual if the NAC rejects him. Otherwise, data can be distorted.

The special academic requirement is reflected in one of two separate ways. If the designator requires graduates of specialized programs, an estimate can be directly obtained for the current year graduate pool from the Digest of Educational Statistics. This number is then placed at the top of the Supply flow at current year graduates and the need for the operator is eliminated. However, if a certain grade point is required, or a special exam such as Aviation Qualification Test/Flight Aptitude Rating (AQT/FAR) is administered, then the screen for special academic requirements is used. Again a sample size of 664 individuals will yield a precision of plus or minus .05 on the estimator

developed. Retention of data in the databank can again yield estimates for current restrictions based on actual information.

The screen OAR operator reflects the percentage of candidates capable of passing a test which measures basic aptitude required for an Officer Program. Most programs which require only short training periods of a few weeks, such as Officer Candidate School and Aviation Officer Candidate Training, will require this exam. Four year programs such as Naval Reserve Officer Training Corps do not require this exam. The specific programs which do or do not require the exam can be obtained from the Commission Source tables in Section 3. The screen OAR test operator can be tracked similarly to the screen physical operator. By keeping all initially interested candidates on the computer tape until year-end, and entering pass or fail, it can easily be determined what percent pass the OAR from actual data.

A subject which is often ignored in manpower analysis, but should not be, is variance of estimates. Statement of a numerical estimate for any value must be accompanied by some confidence level for the estimate. The most reasonable way to express this confidence in mathematically precise terms is to use variance. Variance is especially useful in manpower estimates, because manpower models usually have "nice" properties, so that the central limit theorem enables us to use a normal distribution for the model. The supply data in this model were gathered predominantly from reference 6 and reference 8, published by the U.S. Department of Health,

Education, and Welfare. Variances of their estimates are not furnished. Liaison with H.E.W. statisticians is recommended to determine the variance of these supply estimates.

2.3 THE DEMAND SUBMODEL

The demand submodel applies a series of operators to the projected demand for commissioned officers. These are: program source failures, program selection failures, and program qualification failures.

Projected demand for commissioned officers represents an estimate of the number of civilians who will be needed as accessions into the U.S. Navy Officer Corps. Projected requirements is equal to the number of selected applicants completing commissioning requirements.

The program source failures operator takes into account the percentage of selected officer candidates who enter a pre-commissioning program, such as NROTC or OCS, but ultimately fail to qualify for commission. Since some candidates do fail, a larger number of candidates must be inducted into a program than the number of commissions required. Hence the need to increment selected applicants completing commissioning requirements with the program source failure operator to result in the number of selected applicants required.

The program selection failure operator reflects the fact that not all qualified candidates are selected for an officer program. In order to maintain a highly qualified, talented

officer corps, it is desirable to have many qualified applicants to choose from, so that only the best qualified, and most promising of the candidates need to be selected. Thus the number of selected applicants needs to be incremented by the program selection failure operator to produce the required number of qualified applicants.

The program qualification failure operator reflects the percentage of candidates who are interested in an officer program, but fail to qualify. The reasons for failure can be seen by looking at the supply operators in this model. If a candidate falls outside the tolerances of these supply operators, he has failed to qualify. Thus the qualified applicants must be incremented by the program qualification failure operator to reflect total applicants required.

Since the supply final ouptut reflects current year graduates, the demand final output must reflect current year graduates also, so that the two numbers can be meaningfully compared. Therefore a loss operator is required to reduce total applicants to current year applicants.

2.4 DETERMINATION AND INTERPRETATION OF THE ACQUISITION RATIO

As discussed in Section 2.1, the supply population flows through a series of loss operators. After flowing through age, physical exam, National Agency Check, special academic requirements, and Officer Aptitude Rating, the population still must pass through two critical operators, the potentially interested screen and the recruiter contact screen.

The potentially interested screen represents the percentage of the qualified population who would be interested in becoming a commissioned U.S. Naval Officer, provided they are contacted by a recruiter. The recruiter contact screen reflects the percentage of the qualified population contacted by recruiters. Since both these events must occur for a potentially qualified candidate to become an officer, the product of the two operators represents the percentage of the population who will flow through both, provided the two operators are independent of each other. Independence seems to be a reasonable assumption. The ratio of the population of supply remaining after OAR screen divided by current year graduate applicants, which is defined in this model as acquisition ratio, communicates the number of qualified candidates who exist in the private sector compared to the number of candidates who must be recruited into the U.S. Navy. The reciprocal of this number communicates the percentage of supply candidates who must continue to flow past the OAR screen through the last two operators, potentially interested and recruiter contact, in order that the U.S. Navy may meet its Officer recruiting goals. The fact that this inverse acquisition ratio is the product of the potentially interested operator and the recruiter contact operator enables one to analyze each operator as a function of the other.

2.5 Assumptions

The construction of a personnel model requires the use of many assumptions and constraints which are then subject to change in the future. The assumptions and constraints used in this model are listed below:

1. The U.S. Naval Academy will be needed for the foreseeable future.
2. Both men and women are counted in the supply of potential applicants for commissions requiring professional degrees (JAG, Medical, Nurse Corps).
3. Operators of the model will be constant for a five-year period.
4. Only active-duty commissions are to be evaluated.
5. Only degrees conferred in the United States will be considered in the supply available.
6. All operators of the model are independent.

3. ANALYSIS OF INDIVIDUAL PROGRAMS

3.1 METHOD OF PROGRAM ANALYSIS

In this section, officer recruiting will be broken down into the various officer designators and analyzed individually program by program. The designators are described in Table 1 and will be used henceforth. Operators will be used in each of the programs analyzed to compute supply and demand data so that an acquisition ratio can be computed for fiscal years 1975 to 1979. This acquisition ratio will then be analyzed to determine some combinations of recruiter effectiveness and candidate interest level sufficient to achieve projected goals.

The actual numbers developed in this model are not refined enough to draw specific conclusions from this study concerning individual programs. It is the development of the format which is the worthwhile contribution being strived for. More accurate operators, developed through the methods recommended in Section 2, are necessary before specific conclusions may be drawn.

The supply operators are derived as follows. Current graduates (percent direct from college) were estimated using reference 8, except for professional degrees. It was necessary to use current graduates instead of total graduates because of the insurmountable difficulty of computing the total. The current year comparison of supply to demand should be of equal merit compared to a comparison of total supply to demand. Footnotes are used to credit the source in each case.

TABLE 1

EXPLANATION OF OFFICER DESIGNATORS

Designator	Officer Job Description
111x	Unrestricted Line
112x	Submariner
131x	Pilot
132x	Naval Flight Officer
14xx	Engineering Duty Officer
15xx	Aviation Engineering Duty Officer
16xx	Special Duty (Intelligence)
17xx	Special Duty (Intelligence)
18xx	Oceanography/Meteorology
210x	Physician
220x	Dentist
230x	Medical Service Corps
250x	JAG Corps (Lawyers)
290x	Nurse Corps
310x	Supply Corps
410x	Chaplain's Corps
510x	Civil Engineer Corps

The age operator was estimated from data in Reference 8 page 78. Screen physical, screen NAC, and screen OAR estimates were obtained through phone conversations with Officer Recruiters in nine separate Recruiting Districts. They are tabulated in Table 2. No empirical data were available for specific academic requirements, where they were necessary, so that unsubstantiated numbers were utilized in order to manipulate the model. The values of the operators derived in each program are stated in the discussion of the specific program.

The demand operators were obtained through liaison with The Bureau of Naval Personnel and the U.S. Naval Recruit Command Headquarters. Commissions required (selectees completing commissioning requirements) were furnished by BUPERS (See Appendix A) and ratios of qualified applicants divided by commissions required and total applicants divided by qualified applicants were furnished by NAVCRUITCOM. These were broken down by designator and are tabulated in Table 3. The specific values are stated in the individual program analyses. The percentage of applicants who are current year graduates was estimated by phone conversations with nine recruiting districts and are shown in Table 2 as percent direct from college. Unsubstantiated numbers were used for applicants selected, so that the model could be exercised. It should be pointed out, however, that valid estimates were obtained from reliable sources for both the upstream and

TABLE 2

OPERATOR ESTIMATES FURNISHED BY RECRUITING DISTRICTS

	Fail Rate Physicals		Percent Direct from college	Fail Rate NAC	Fail Rate OAR
	Aviation	Regular			
MEMPHIS	.10	.10	.85	.01	.02
MIAMI	.15	.09	.40	.01	.01
JACKSONVILLE	.10	.10	.70	.01	.01
HOUSTON	.07	.02	.90	.01	.03
MONTGOMERY	.10	.10	.50	.01	.01
SAN ANTONIO	.10	.10	.95	.01	.01
SAN FRANCISCO	.22	.08	.50	.01	.01
SEATTLE	.20	.20	.42	.01	.01
WASHINGTON,D.C.	.23	.15	.50	.01	.01
Average:	.142	.104	.6356	.01	.01

TABLE 3

DEMAND OPERATOR RATIOS
FURNISHED BY NAVCRUITCOM

Designator	Qualified Applicant / Commissions Required	Total Applicants / Qualified Applicants
11xx	4.44:1	1.98:1
131x	4.44:1	1.98:1
139x	5:1	5:1
132x	5:1	5:1
137x	5:1	5:1
14xx	5:1	5:1
15xx	15:1	3:1
16xx	10:1	3:1
19xx	2.2:1	1.1:1
210x	2.13:1	4:1
220x	2:1	4:1
230x	1.5:1	3.75:1
250x	2.5:1	1.1:1
290x	2:1	2:1
310x	2:1	3:1
410x	1.7:1	1.1:1
510x	2:1	5:1

downstream values, relative to selected applicants, in Figure 1, so that lack of precise information for the operator should have minimal impact.

The method of presentation is as follows. The estimate for each specific operator is stated. Next, several combinations of interest level and recruiter effectiveness required to achieve the program goals in FY1975 are enumerated. These values are the direct result of the computation of acquisition ratio for the particular program. For example, in Section 3.2.1, acquisition ratio in FY1975 is 30.44. This means that 1 of every 30.44 qualified candidates must be interested in a Navy career and must be contacted by a recruiter in order for the Navy to achieve its goal for FY1975. Since the reciprocal of acquisition ratio must equal the product of interest level times recruiter contact, various combinations of the two which will achieve the goal can easily be set forth.

Next, a set of composite characteristics of a candidate are described. These are based on the table of sources which lists all programs which recruit for the specific program and the characteristics they require. For example, in Section 3.2.1, the composite characteristics are based on the information provided by Table 4.

The final portion of each program is the table which computes acquisition ratio. The supply pool starts at the top of the page and flows toward the middle through a series of loss operators. The demand pool starts at the bottom of the page and flows through a series of incremental

operators toward the middle. Acquisition ratio, separated by the heavy lines, is the ratio of the number just above it (supply output after OAR operator) divided by the number just below it (demand output).

3.2 THE PROGRAMS

3.2.1 Development of Acquisition Ratio (designator 111x, surface, male)

4.44 qualified applicants are required for each commission. 1.98 applicants are required for each qualified applicant. The Age, Physical, NAC, and OAR operators are .97, .896, .99, and .95, respectively. The unsubstantiated estimate for special academic requirement is .90. Having some estimate available allows the manipulation of the model to be carried out. Methods of obtaining more accurate estimates in the future are discussed in Chapter 2.

The reciprocals of acquisition ratio for Program A, 1975 to 1979, are .033, .025, .016, .028, and .026, respectively. This means that approximately 3 percent of the potentially qualified candidates must become applicants satisfactorily to achieve the program goal. Some combinations of interest level and recruiter contact effectiveness which will achieve this goal in FY 1975 are shown below:

$(\text{acquisition ratio})^{-1}$	=	interest level	x	recruiter effectiveness
.03	=	.03		1.00
.03	=	.16		.16
.03	=	.40		.08
.03	=	1.00		.03

TABLE 4

COMMISSION SOURCES
(designator 111x, surface, male)

	NROTC	OCS	ROC	Merchant Marine Grad.	NROTC 2 YR NUPOC	NUPOC COLLEGIATE
Age (Commission)	21-25	19-27½	21-29	21-25	19-26½	19-26½
Physical	STD	STD	STD	STD	STD	STD
NAC	STD	STD	STD	STD	STD	STD
Special academic requirements	College board	degree	"C" average	degree	Rickover interview	Rickover interview
OAR	No	Yes	ROAT	Yes	Yes	Yes
Interest level	High	Low	Low	Low	Medium	Medium

TABLE 5

COMPUTATION OF ACQUISITION RATIO
(designator 111x, surface)

	FY 1975	1976	1977	1978	1979
Total graduates	502,370[A] 499,327[B]	490,327[B]	469,346[B]	480,237[B]	488,203[B]
Age 19-29	484,347	475,617	455,266	465,830	473,557
Physical	433,975	426,153	407,918	417,384	424,307
NAC	429,635	421,891	403,839	413,210	420,064
At least "C" average	386,672	379,702	363,455	371,889	378,058
OAR	367,338	360,717	345,282	353,294	359,155
Acquisition ratio	30.44	39.90	63.15	36.23	38.08
Applicant from current graduating class	12,076	9,041	5,468	9,751	9,432
Total applicants required	19,000	14,224	8,603	15,341	14,839
Qualified applicants	9,600	7,187	4,347	7,751	7,498
Applicants selected	5,800	4,402	2,662	4,747	4,593
Selectees completing commissioning requirements	2,160	1,617	978	1,744	1,687

[A] Ref. 5 page 394.

[B] Ref. 6 page 46.

Thus if everyone eligible were interested in a Navy career, only 3 percent of the qualified population need be contacted by recruiters. If 3 percent of the population is interested in a Navy career, the entire qualified population must be contacted. All other combinations lie between these two extremes.

The composite characteristics of the candidate characterized by the table of sources are: a male 19 to 29 years of age at time of commissioning; capable of passing the standard physical, OAR, and NAC; and at least a C average. The table of commission sources shows a combination of high, low, and medium interest programs.

3.2.2 Development of Acquisition Ratio (designator 112x, submariners)

4.44 qualified applicants are required for each commission. 1.98 applicants are required for each qualified applicant. The Age, Physical, NAC, and OAR operators are .96, .896, .99, and .95, respectively. The unsubstantiated estimate for special academic requirement is .90. Having some estimate available allows the manipulation of the model to be carried out. Methods of obtaining more accurate estimates in the future are discussed in Chapter 2.

The reciprocals of acquisition ratio for Program B, 1975 to 1979, are .007, .005, .003, .006, and .006, respectively. This means that approximately 1 percent of the potential qualified candidates must become applicants

satisfactorily to achieve the program goal. Some combinations of society interest level and recruiter contact effectiveness which will achieve the goal for 1975 are shown below.

$(\text{acquisition ratio})^{-1}$	=	interest level	x	recruiter effectiveness
.01	=	.01		1.00
.01	=	.10		.10
.01	=	.40		.03
.01	=	1.00		.01

Thus if everyone eligible were interested in a Navy career, only 1 percent of the qualified population need be contacted by recruiters. Other combinations lie between these two extremes.

The composite characteristics of the candidate characterized by the table of sources are: a male 19 to 26½ years of age at time of commissioning; capable of passing the standard physical, OAR, and NAC; at least a C average in college; and capable of impressing Admiral Rickover in an interview. The table of commission sources shows a combination of high, medium, and low interest programs.

The commission accessions required was computed by using 10 percent of projected 11xx requirements. More exact estimates could be obtained by an analyst serving in the Recruit Command, but the estimate used here suffices to illustrate the method of evaluation proposed.

TABLE 6

COMMISSION SOURCES
(designator 112x, submarines)

	NROTC	NROTC 2YR NUPOC	OCS 1105 NUPOC	NUPOC COLLEGIATE
Age (Commission)	21-25	19-26½	19-26½	19-26½
Physical	STD	STD	STD	STD
NAC	STD	STD	STD	STD
Special academic requirements	College board Rickover interview	Rickover interview	"B" average Rickover interview	"B"average Rickover interview
OAR	No	Yes	Yes	Yes
Interest level	High	Medium	Low	Medium

TABLE 7

COMPUTATION OF ACQUISITION RATIO
(designator 112x, submarines)

	FY 1975	1976	1977	1978	1979
Total graduates	502,370[A] 499,327[B]	490,327[B]	469,346[B]	480,237[B]	488,203[B]
Age 19-26½	479,354	470,714	450,572	461,028	468,675
Physical	429,501	421,760	403,713	413,081	419,933
NAC	425,206	417,542	399,676	408,950	415,733
Special academic requirements	212,603	208,771	199,838	204,475	208,867
OAR	201,973	198,332	189,846	194,251	197,473
Acquisition ratio	139.46	182.96	290.28	166.31	174.91
Applicants from current graduating class	1,448	1,084	654	1,168	1,129
Total applicants required	2,278	1,706	1,029	1,838	1,777
Qualified applicants	1,151	862	520	929	898
Applicants selected	705	528	318	569	550
Selectees completing commissioning requirements	259	194	117	209	202

[A] Ref. 5 page 394.

[B] Ref. 6 page 46.

3.2.3 Development of Acquisition Ratio (designator 111x, female)

4.44 qualified applicants are required for each commission. 1.98 applicants are required for each qualified applicant. The Age, Physical, NAC and OAR operators are .97, .896, .99, and .95, respectively. Methods of obtaining more accurate estimates in the future are discussed in Chapter 2.

Assuming 6% of 11xx Officers are women, the reciprocals of acquisition ratio for program C, 1975 to 1979, are .002, .002, .001, .002, and .002, respectively. This means that approximately 2 out of 1000 of the potentially qualified candidates must become applicants satisfactorily to achieve the program goal. Even if 30% of 11xx Officers are women, the acquisition ratio is comfortably higher than that for male 11xx surface officers, so no recruiting difficulties are anticipated for this program.

The composite characteristics of the candidates characterized by the table of sources are: a female 18 to 27½ years of age at time of commissioning with a college degree and capable of passing physical, NAC, and OAR examinations. The table of commission sources shows a combination of high, medium, and low interest programs.

The commission accessions required was computed in Fiscal Year 1975 by assuming both 6% and 30% of 11xx officers are women. The 6% estimate was obtained from 1974 data. For the years 1975 to 1980, two separate percentages were used to

TABLE 8

COMMISSION SOURCES
(designator 111x, female)

	NROTC	OCS (college junior)	OCS Women
Age (commission)	21-25	18-27½	20-27½
Physical	STD	STD	STD
NAC	STD	STD	STD
Special academic requirements	college board SAT	None	None
OAR	No	WOQT	Yes
Interest level	High	Medium	Low

TABLE 9

COMPUTATION OF ACQUISITION RATIO
(designator 11xx, female)

	FY 1975	1976	1977	1978	1979
Total graduates	433,000[A]	434,000[A]	441,000[A]	452,000[A]	459,000[A]
Age 18-27½	420,010	420,980	427,770	438,440	445,230
Physical	376,329	377,198	383,282	392,842	398,926
NAC	372,566	373,426	379,449	388,914	394,937
OAR	353,937	354,755	360,477	369,468	375,190
Acquisition ratio	475.72* 95.63#	640.35* 127.93#	1069.66* 215.19#	614.76* 123.57#	650.24* 129.69#
Applicants from current graduating class	744* 3,705#	544* 2,773#	337* 1,675#	601* 2,990#	577* 2,893#
Total applicants required	1,144 5,700	853 4,266	519 2,577	924 4,600	888 4,451
Qualified applicants	578 2,880	431 2,156	262 1,302	467 2,324	449 2,249
Applicants Selected	362 1,755	253 1,277	157 784	282 1,426	225 1,372
Selectees completing commissioning requirements	130 648	97 485	59 293	105 523	101 506

* upper figure based on 6% 11xx officers female
\# lower figure based on 30% 11xx officers female

[A]Ref. 6 page 46.

assess the impact should the Navy increase the percent of 11xx officer accessions who are women.

3.2.4 Development of Acquisition Ratio (designator 131x, aviation)

4.44 qualified applicants are required for each commission. 1.98 applicants are required for each qualified applicant. The Age, Physical, NAC, and special academic requirement estimates were obtained from Reference 3 page 3-11, and are .97, .384, .938, and .525, respectively.

The reciprocals of acquisition ratio for this designator, 1975 to 1979, are .180, .191, .231, .226, and .222, respectively. This means that approximately 20 percent of the potential qualified candidates must become applicants satisfactorily to achieve the program goal. Some combinations of interest level and recruiter contact effectiveness which will achieve this goal for 1975 are shown below.

$(\text{acquisition ratio})^{-1}$	=	interest level	x	recruiter effectiveness
.18	=	.18		1.00
.18	=	.42		.42
.18	=	1.00		.18

Thus, if everyone eligible were interested in a Navy career, 18 percent of the population would have to be contacted by recruiters. Conversely, if 18 percent of the population were interested in a Navy career, the entire qualified population would have to be contacted. All other combinations lie between these two extremes.

TABLE 10

COMMISSION SOURCES
(designator 131x, male)

	NROTC	NFOC	AVROC
Age (commission)	21-25	19-27½	17-27½
Physical	Aviation	Screen + Aviation	Screen + Aviation
NAC	STD	STD	STD
Special academic requirements	College board SAT AQT/FAR	AQT/FAR	"C" average AQT/FAR
OAR	No	No	No
Interest level	High	Low	Low

TABLE 11

COMPUTATION OF ACQUISITION RATIO
(designator 131x, male)

	FY 1975	1976	1977	1978	1979
Total graduates	502,370[A] 499,327[B]	490,327[B]	469,346[B]	480,237[B]	488,203[B]
Age (commission)	484,347	475,617	455,266	465,830	473,557
Physical	185,989	182,637	174,822	178,879	181,846
NAC	174,458	171,314	163,983	167,788	170,571
AQT/FAR	91,590	89,940	86,091	88,089	89,550
Acquisition ratio	5.56	5.24	4.33	4.43	4.51
Applicants from current graduating class	16,478	17,161	19,863	19,863	19,863
Total applicants required	25,925	27,000	31,250	31,250	31,250
Qualified applicants	5,185	5,400	6,250	6,250	6,250
Applicants selected	3,111	3,240	3,750	3,750	3,750
Selectees completing commissioning requirements	1,037	1,080	1,250	1,250	1,250

[A] Ref. 5 page 394.

[B] Ref. 6 page 46.

The composite characteristics of the candidates characterized by the table of sources are: a male 19 to 27½ years of age at time of commissioning capable of passing physical, NAC, and AQT/FAR examinations. The table of commission sources shows a combination of high, low, and medium interest programs. Allowing persons with two years of college to enter flight training would increase the supply pool by approximately 70,000, according to Reference 3, page 3-9.

Many of the options available to raise interest level are already in use, so it would be difficult and expensive to increase the levels of interest, short of implementing the draft.

3.2.5 Development of Acquisition Ratio (designator 132x, male)

5 qualified applicants are required for each commission. 5 applicants are required for each qualified applicant. The Age, Physical, NAC, and special academic requirement estimates were obtained from Reference 3 page 3-12, and are .97, .473, .938, and .782, respectively.

The reciprocals of acquisition ratio for this designator 1975 to 1979 are .054, .055, .058, .057, and .056, respectively. This means that approximately 6 percent of the potential qualified candidates must become applicants satisfactorily to achieve the program goal. Some combinations of interest level and recruiter contact effectiveness which will achieve this goal for 1975 are shown below.

(acquisition ratio)$^{-1}$	=	interest level x recruiter effectiveness
.05	=	.05 1.00
.05	=	.24 .24
.05	=	1.00 .05

Thus, if everyone eligible were interested in a Navy career, 5 percent of the qualified population must be contacted by recruiters. Conversely, if 5 percent of the population are interested, then the entire population must be contacted. All other combinations lie between the two extremes.

The composite characteristics of the candidate characterized by the table of sources are: a male 19 to 27½ years of age at commissioning capable of passing the standard physical, NAC, and AQT/FAR examinations. The table of commission sources shows a combination of high, low and medium interest programs available.

Many of the options cited in the discussion of interest level in Chapter 1 are already in use, so it would be difficult and expensive to increase the current level of interest, short of implementing the draft. Since the AQT/FAR and physical for 132x has a lower failure rate than 131x, and since the acquisition ratio is higher, this program's goals should be much easier to fill than the 131x program for the foreseeable future.

TABLE 12

COMMISSION SOURCES
(designator 132x, male)

	NROTC	NFOC	AVROC
Age (commission)	21-25	19-27½	17-27½
Physical	Aviation	Screen + Aviation	Screen + Aviation
NAC	STD	STD	STD
Special academic requirements	college board AQT/FAR	AQT/FAR	AQT/FAR
OAR	No	No	No
Interest level	High	Low	Low

TABLE 13

COMPUTATION OF ACQUISITION RATIO
(designator 132x, male)

	FY 1975	1976	1977	1978	1979
Total graduates	502,370[A] 499,327[B]	490,327[B]	469,346[B]	480,237[B]	488,203[B]
Age (commission)	484,327	475,617	455,266	465,830	473,557
Physical	229,026	224,967	215,341	220,338	223,992
NAC	214,892	211,019	201,990	206,677	210,105
AQT/FAR	168,046	165,017	157,956	161,621	164,302
Acquisition ratio	18.360	18.029	17.257	17.658	17.951
Applicant from current graduating class	9,153	9,153	9,153	9,153	9,153
Total applicants required	14,400	14,400	14,400	14,400	14,400
Qualified applicants	2,880	2,880	2,880	2,880	2,880
Applicants selected	1,729	1,728	1,728	1,728	1,728
Selectees completing commissioning requirements	576	576	576	576	576

[A]Ref. 5 page 394.

[B]Ref. 6 page 46.

3.2.6 Development of Acquisition Ratios (designators 14xx, 15xx, 16xx, 17xx, 18xx (RESTRICTED LINE))

5, 15, 10, 10, and 10 applicants, respectively, are required for each commission. 5, 3, 3, 3, and 3 applicants, respectively, are required for each qualified applicant. The Age, Physical, NAC, and OAR operators are .97, .896, .95, and .95, respectively, except the NAC is .90 for 16xx because both the candidate and his wife must pass, instead of only the candidate, as in other programs. Methods of obtaining more accurate estimates in the future are discussed in Chapter I.

The reciprocals of acquisition ratio for designator 14xx, 1975 to 1979, are .008, .006, .007, .007, .004, for designator 15xx are .023, .016, .008, .011, .016, for designator 16xx are .006, .005, .005, .006, .006, respectively, and is almost infinite for 17xx and 18xx, since the demand is approximately zero between 1976 and 1979 for both of these programs. This means that approximately 7 of 1000 of the potential qualified 14xx candidates, approximately 1 of 100 of the potential qualified 15xx candidates, and approximately 1 of 200 of the potential qualified 16xx candidates must become applicants satisfactorily to achieve the program goals.

The acquisition ratios are so high that no problems in officer recruiting are foreseen in any of the restricted line designators in the foreseeable future. Since this is true, the Navy can be highly selective and choose only individuals with high motivation to make the Navy a career.

TABLE 14
COMMISSION SOURCES
(designators 14xx, 15xx, 16xx)

	14xx (OCS)	15xx (Restricted Line) (OCS)
Age (commission)	19-27½	19-27½
Physical	STD	STD
NAC	STD	STD
Special academic requirements	Special degrees only	Special degrees only
OAR	Yes	Yes
Interest level	Low	Low

16xx

	NAOC (SDI)	OCS (Cryptology)	OCS (Intelligence)
Age (commission)	19-27½	19-27½	19-27½
Physical	STD	STD	STD
NAC	STD + wife	STD	STD + wife
Special academic requirements	AQT/FAR	special degree "desirable"	special degree "preferred"
OAR	No	Yes	Yes
Interest level	Low	Low	Low

TABLE 15

COMPUTATION OF ACQUISITION RATIO
(designator 14xx, EDO)

	FY 1975	1976	1977	1978	1979
Total graduates	54,443[A]	53,936[B]	51,628[B]	52,826[B]	53,702[B]
Age 19-27½	52,810	52,318	50,079	51,241	52,091
Physical	47,318	46,877	44,871	45,912	46,673
NAC	44,954	44,533	42,627	43,617	44,340
OAR	42,704	42,306	40,496	41,436	42,123
Acquisition ratio	127.86	156.69	141.59	144.88	264.86
Applicant from current graduating class	334	270	286	286	159
Total applicants required	525	425	450	450	250
Qualified applicants	105	85	90	90	50
Applicants selected	61	52	59	59	30
Selectee completing commissioning requirements	21	17	18	18	10

[A] Ref. 8 page 96.

[B] Estimated using 1975 ratio of engineering degrees to total degrees.

TABLE 16

COMPUTATION OF ACQUISITION RATIO
(designator 15xx, AEDO)

	FY 1975	1976	1977	1978	1979
Total graduates	52,061[A]	50,890[B]	48,713[B]	49,843[B]	50,670[B]
Age 19-27½	50,499	49,363	47,252	48,348	49,150
Physical	45,247	44,230	42,337	43,320	44,038
NAC	44,795	43,787	41,914	42,886	43,598
OAR	42,555	41,598	39,818	40,742	41,418
Acquisition ratio	43.78	60.64	126.41	88.96	62.95
Applicant from current graduating class	972	686	315	458	658
Total applicants required	1,530	1,080	495	720	1,035
Qualified applicants	510	360	165	240	345
Applicants selected	272	192	91	129	183
Selectees completing commissioning requirements	34	24	11	16	23

[A] Ref. 8 page 96.

[B] Estimated using 1975 ratio of AEDO degrees to total degrees.

TABLE 17

COMPUTATION OF ACQUISITION RATIO
(designator 16xx, special duty)

	FY 1975	1976	1977	1978	1979
Total graduates	502,370[A]	490,327[B]	469,327[B]	480,327[B]	488,327[B]
Age 19-27½	487,299	475,617	455,247	465,917	473,677
Physical	436,620	426,153	407,901	417,462	424,415
NAC (+ wife)	401,690	392,061	375,269	384,065	390,462
Special academic requirement	241,014	235,236	225,162	230,439	234,277
OAR	228,963	223,475	213,904	218,917	222,563
Acquisition ratio	153.98	202.06	211.58	155.15	155.64
Applicant from current graduating class	1,487	1,106	1,011	1,411	1,430
Total applicants required	2,340	1,740	1,590	2,220	2,250
Qualified applicants	780	580	530	740	750
Applicants selected	429	319	292	407	413
Selectees completing commissioning requirements	78	58	53	74	75

[A] Ref. 5 page 394.

[B] Ref. 6 page 50

The composite chararacteristics of the candidate characterized by the table of sources are: a male 19 to 27½ years of age at time of commissioning, capable of passing the standard physical, NAC, and OAR examination. The table of commission sources shows only low interest programs.

3.2.7 Development of Acquisition Ratio (designator 210x, medical)

2.13 qualified applicants are required for each commission. 4 applicants are required for each qualified applicant. Screen for age is assumed to be 1.0 due to the wide age range allowed (19 to 43 years of age). Physical and NAC are .896 and .99, respectively.

The reciprocals of acquisition ratio for this designator, 1975 to 1979, are .508, .602, .188, .461, and .417, respectively. This means that approximately 50 percent of the potential qualified candidates must become applicants satisfactorily to achieve the program goal. Some combinations of interest level and recruiter contact effectiveness which will achieve this goal for 1975 are shown below.

$(\text{acquisition ratio})^{-1}$	=	interest level	x	recruiter effectiveness
.508	=	.508		1.000
.508	=	.713		.713
.508	=	1.000		.508

Thus if everyone eligible were interested in a Navy career, 51 percent of the eligible population must be contacted by recruiters. If 51 percent of the population is

potentially interested, everyone must be contacted. All other combinations lie between these two extremes.

The composite characteristics of the candidate characterized by the table of sources are: male or female 19 to 43 years of age at time of commissioning, capable of passing the standard physical and NAC examination. The table of commission sources shows a combination of high, low, and medium interest programs.

Applying the general discussion of interest level contained in Chapter I to this specific program, several options are currently in effect, such as a reenlistment bonus, scholarship program, and special pay. Some analysts feel that more incentives are available than necessary for this program.[6] Some proposals, if they are accepted may rapidly assist in alleviating the doctor shortage.[7] Recent difficulties in purchasing malpractice insurance in the private sector may be a significant positive factor for recruiters in the very near future.

3.2.8 Development of Acquisition Ratio (designator 220x, dental)

2 qualified applicants are required for each commission. 4 applicants are required for each applicant. Screen for Age is assumed to be 1.0 due to the wide range allowed (19 to 48 years of age). Physical and NAC are .896 and .95, respectively.

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[6] Ref. 4 page 20.

[7] Ref. 7 page 47.

TABLE 18

COMMISSION SOURCES
(designator 210x)

	Medical Osteo	Medical Osteo (senior)	AFHSP	First Year Grad Med Educ. Prog.	Direct Apptment (Reserve)	NADDS	Direct Apptment
Age (commission)	19-33	19-33	19-33	21-41	21-41	21-41	Any-43
Physical	STD	STD	STD	STD	STD	STD	STD
NAC	STD	STD	STD	STD	STD	STD	STD
Special academic requirements	Med School accredited by AMA or AOA	Med School accredited by AMA or AOA	MCAT	Senior year Medical School	Various	Graduate AMA Medical Schl or licensed	Various
OAR	No	No	No	No	No	No	No
Interest level	Medium	Low	High	Medium	Medium	High	Medium

TABLE 19

COMPUTATION OF ACQUISITION RATIO
(designator 210x, Medical Corps)

	FY 1975	1976	1977	1978	1979
Total graduates	10,100[A]	10,600[A]	11,291[A]	11,949[A]	12,608[A]
Age 19-43	10,770[B]	11,730[B]	12,740[B]	13,200[B]	13,730[B]
Physical	9,050	9,498	10,117	10,706	11,297
NAC	8,959	9,403	10,016	10,599	11,184
Acquisition ratio	1.97	1.66	2.05	2.17	2.40
Applicants from current graduating class	4,549	5,680	4,885	4,895	4,663
Total applicants required	7,157	8,937	7,685	7,702	7,336
Qualified applicants	1,789	2,234	1,921	1,926	1,834
Applicants selected	1,314	1,641	1,411	1,415	1,347
Selectees completing commissioning requirements	840	1,049	902	904	861

[A] Ref. 6 page 87.

[B] Ref. 6 page 59.

The reciprocals of acquisition ratio for this designator, 1975 to 1979, are .552, .714, .474, .476, and .456, respectively. This means that approximately 50 percent of the potential qualified candidates must become applicants satisfactorily to achieve the program goal. Some combinations of interest level and recruiter contact effectiveness which will achieve the goal in 1975 are shown below.

$(\text{acquisition ratio})^{-1}$	=	interest level	x	recruiter effectiven
.552	=	.552		1.000
.552	=	.743		.743
.552	=	1.000		.552

Thus if everyone eligible were interested in a Navy career, 55 percent of the eligible population must be contacted by recruiters. If 55 percent of the population is potentially interested, everyone must be contacted. All other combinations lie between these two extremes.

The composite characteristics of the candidate characterized by the table of sources are: male or female 19 to 48 years of age at time of commissioning, capable of passing the standard physical and NAC examination. The table of commission sources shows a combination of high, low, and medium interest programs available.

Analyzing interest level, available options are not utilized, since the Navy is currently able to achieve its goals without special incentives except the scholarship program. This seems to indicate that graduates of dental schools perceive the Navy in a more favorable light than do graduates

TABLE 20

COMMISSION SOURCES
(designator 220x)

	1925 Inactive	1925 Active	AFHSP 1985	Dental Reserve	Dental Regular	DGPRP (dentistry)
Age (commission)	19-33	19-33	19-33	21-48	21-41	21-33
Physical	STD	STD	STD	STD	STD	STD
NAC	STD	STD	STD	STD	STD	STD
Special academic requirements	Accredited ADA School	Accredited ADA School	Accredited ADA School	Graduate Accredited ADA School	Graduate Accredited ADA School	Senior ADA Accredited School
OAR	No	No	No	No	No	No
Interest level	High	High	High	Low	Low	Medium

TABLE 21

COMPUTATION OF ACQUISITION RATIO
(designator 220x, Dental Corps)

	FY 1975	1976	1977	1978	1979
Total graduates	4,570[A]	4,740[A]	5,060[A]	5,140[A]	5,210[A]
Age 19-48	4,570	4,740	5,060	5,140	5,210
Physical	4,095	4,247	4,534	4,605	4,668
NAC	3,890	4,035	4,307	4,375	4,435
Acquisition ratio	1.81	1.40	2.11	2.10	2.19
Applicants from current graduating class	2,151	2,878	2,039	2,085	2,024
Total applicants required	3,384	4,528	3,208	3,280	3,184
Qualified applicants	846	1,132	802	820	796
Applicants selected	635	849	602	615	597
Selectees completing commissioning requirements	423	566	401	410	398

[A]Ref. 6 page 59.

of medical schools, since acquisition ratios for the two programs are approximately equal.

3.2.9 Development of Acquisition Ratio (designator 230x, medical service corps)

1.5 qualified applicants are required for each commission. 3.75 applicants are required for each qualified applicant. Screen for age is assumed to be 1.0 due to the wide age range allowed (19 to 40 years of age). Physical and NAC are .896 and .99, respectively.

The reciprocals of acquisition ratio for this designator, 1975 to 1979, are .223, .132, .046, .042, and .078, respectively. This means that approximately 5 to 10 percent of the potential qualified candidates must become applicants satisfactorily to achieve the program goal. Some combinations of interest level and recruiter contact effectiveness which will achieve this goal for 1975 are shown below.

$(\text{acquisition ratio})^{-1}$	=	interest level	x	recruiter effectiveness
.223	=	.223		1.000
.223	=	.472		.472
.223	=	1.000		.223

Thus if everyone eligible were interested in a Navy career, 13 percent of the eligible population must be contacted by recruiters. If 13 percent of the population is interested in a Navy career, everyone must be contacted. All other combinations lie between these two extremes.

TABLE 22

COMMISSION SOURCES
(designator 230x)

	AFHPS	MSC Student Program	MSC Direct Appointment
Age (commission)	Article 1020200 BUPERS MANUAL	Article 1020200 BUPERS MANUAL	19-40
Physical	STD	STD	STD
NAC	STD	STD	STD
Special academic requirement	Optometry Clinical Psychology	Dietetics Physical Therapy Occupational Therapy Hosp Admin/Health Care Administration	BY SPECIALTY
OAR	No	No	No
Interest level	High	Medium	Low

TABLE 23

COMPUTATION OF ACQUISITION RATIO
(designator 230x, MSC)

	FY 1975	1976	1977	1978	1979
Total graduates	2,922[A]	3,066[A]	3,266[A]	3,457[A]	3,647[A]
Age 19-40	2,922	3,066	3,266	3,457	3,647
Physical	2,618	2,747	2,926	3,097	3,268
NAC	2,592	2,720	2,897	3,066	3,234
Acquisition ratio	4.48	7.60	21.95	23.77	12.74
Applicants from current graduating class	579	358	132	129	254
Total applicants required	911	563	208	203	399
Qualified applicants	243	150	56	54	107
Applicants selected	202	126	47	45	89
Selectees completing commissioning requirements	162	100	37	36	71

[A] estimated from 1974 ratio of MSC to Medical Degrees.

The composite characteristics of the candidate characterized by the table of sources are: male or female 19 to 40 years of age at time of commissioning, capable of passing the standard physical and NAC examination. The table of commission sources shows a combination of high, low, and medium interest programs.

The high acquisition ratio of this program in the out years implies that no recruiting problems will occur in this program for the foreseeable future.

3.3.10 Development of Acquisition Ratio (designator 250x, JAG Corps)

2.5 qualified applicants are required for each commission. 1.1 applicants are required for each qualified applicant. Screen for age is assumed to be 1.0 due to the wide age range allowed (19 to 39 years of age). Physical and NAC are .896 and .99, respectively. The special academic requirement, passing the Bar of one of the States in the United States, is wildly estimated. This value is difficult to ascertain, since each state conducts their own exams and it is difficult to predict which state a candidate takes his exam in.

The reciprocals of acquisition ratio for this designator, 1975 to 1979, are .005, .004, .004, .004, and .005, respectively. This means that approximately ½ of 1 percent of the potential qualified candidates must become applicants satisfactorily to achieve the program goal. This is a clear indication that no recruiting problems should be encountered for this program at least until 1980.

TABLE 24

COMMISSION SOURCES
(designator 250x)

	JAG Student	Direct Appointment
Age (commission)	19-32½	21-39
Physical	STD	STD
NAC	STD	STD
Special academic requirements	LSAT American Bar	Graduate of Law School accredited by American Bar or member Highest Court State or Territory
OAR	No	No
Interest level	High	Low

TABLE 25

COMPUTATION OF ACQUISITION RATIO
(designator 250x, JAG)

	FY 1975	1976	1977	1978	1979
Total graduates	24,010[A] 29,000[B]	24,220[A] 28,300[B]	26,700[A] 28,900[B]	27,350[A] 29,900[B]	28,640[A] 30,700[B]
Age 19-39	24,010	24,220	26,700	27,350	28,640
Physical	21,513	21,701	23,923	24,506	25,661
NAC	21,298	21,484	23,684	24,261	25,405
Special academic academic requirements	15,973	16,113	17,763	18,195	19,054
Acquisition ratio	202.19	273.10	273.28	267.56	214.09
Applicants from current graduating class	79	59	65	68	89
Total applications required	124	94	102	107	140
Qualified applicants	113	85	93	98	128
Applicants selected	79	60	65	70	81
Selectees completing commissioning requirements	45	34	37	39	51

[A]Ref. 5 page 80.

[B]Ref. 6 page 59.

The composite characteristics of the candidate characterized by the table of sources are: male or female 19 to 39 years of age at time of commissioning, capable of passing the standard physical and NAC examination, and a member of the Bar of some state in the United States. The table of commission sources shows a high and a low interest program available.

3.2.11 Development of Acquisition Ratio (designator 290x, Nurse Corps)

2 qualified applicants are required for each commission. 2 applicants are required for each qualified applicant. The Age, Physical, and NAC are .99, .896, and .99, respectively.

The reciprocals of acquisition ratio for this designator, 1975 to 1979, are .015, .019, .023, .026, and .025, respectively. This means that approximately 2 percent of the potential qualified candidates must become applicants satisfactorily to achieve the program goal. Some combinations of interest level and recruiter contact effectiveness which will achieve this goal in 1975 are shown below.

$(\text{acquisition ratio})^{-1}$	=	interest level	x	recruiter effectiveness
.015	=	.015		1.000
.015	=	.122		.122
.015	=	1.000		.015

Thus if everyone eligible were interested in a Navy career, 1.5 percent of the eligible population must be contacted by recruiters. If 1.5 percent of the population

TABLE 26

COMMISSION SOURCES
(designator 290x)

	NNCCP	Nurse Corps (Naval Reserve)
Age (commission)	20-35	20-35
Physical	STD	STD
NAC	STD	STD
Special academic requirements	Nurse School accredited by National League for Nursing	Registered Professional or Graduate Nurse scheduled registered examination
OAR	No	No
Interest level	High	Low

TABLE 27

COMPUTATION OF ACQUISITION RATIO
(designator 210x, Medical Corps)

	FY 1975	1976	1977	1978	1979
Total graduates	51,350[A]	53,300[A]	55,050[A]	57,050[A]	58,750[A]
Age 20-35	51,350	53,300	55,050	57,050	58,750
Physical	45,550	47,279	48,832	50,606	52,114
NAC	45,094	46,806	48,343	50,100	51,592
Acquisition ratio	66.22	53.68	42.74	38.19	40.27
Applicants from current graduating class	681	872	1,131	1,312	1,281
Total applicants required	1,072	1,372	1,780	2,064	2,016
Qualified applicants	536	686	890	1,032	1,088
Applicants selected	401	422	664	772	752
Selectees completing commissioning requirements	268	343	445	516	504

[A] Ref. 5 page 127.

is interested in a Navy career, everyone must be contacted. All other combinations lie between these two extremes.

The composite characteristics of the candidate characterized by the table of sources are: male or female 25 to 30 years of age at time of commissioning, capable of passing the standard Physical and NAC examination. The table of commission sources shows a high and a low interest program available.

The high acquisition ratio shows that there should be no recruiting problem for the foreseeable future, barring more restrictive qualifications in the future.

3.2.12 Development of Acquisition Ratio (designator 310x, Supply Corps)

2 qualified applicants are required for each commission. 3 applicants are required for each qualified applicant. The Age, Physical, NAC, and OAR are .98, .896, .95, and .85, respectively. The unsubstantiated estimate for special academic requirements is .75. Having some estimate available allows the manipulation of the model to be carried out. Methods of obtaining more accurate estimates in the future are discussed in Chapter 2.

The reciprocals of acquisition ratio for this program, 1975 to 1979, are .005, .004, .005, .005, and .005, respectively. This means that approximately 1 of 200 of the potential qualified candidates must become applicants satisfactorily to achieve the program goal.

TABLE 28

COMMISSION SOURCES
(designator 310x)

	NROTC	ROC	Staff Corps Supply Corps	OCS College junior (women)	OCS
Age (commission)	21-25	21-29	19-27½	18-27½	20-27½
Physical	STD	STD	STD	STD	STD
NAC	STD	STD	STD	STD	STD
Special academic requirements	College board SAT	"C" average	BS/BA or Higher	Junior at accredited college	BS/BA
OAR	No	ROAT	Yes	WOQT	Yes
Interest level	High	Low	Low	Medium	Low

TABLE 29

COMPUTATION OF ACQUISITION RATIO
(designator 310x, Supply Corps)

	FY 1975	1976	1977	1978	1979
Total graduates	502,370[A]	490,327[A]	469,327[A]	480,327[A]	488,327[A]
Age 19-29	492,323	480,520	459,940	470,720	478,560
Physical	441,121	430,546	412,107	421,766	428,790
NAC	419,065	409,019	391,501	400,677	407,351
Special academic requirement	314,299	306,764	293,626	300,508	305,513
OAR	267,154	260,750	249,582	255,432	259,686
Acquisition ratio	184.37	245.07	218.93	201.76	202.72
Applicants from current graduating class	1,449	1,064	1,140	1,266	1,281
Total applicants required	2,280	1,674	1,794	1,992	2,016
Qualified applicants	760	558	598	664	672
Applicants selected	560	413	349	451	526
Selectees completing commissioning requirements	380	279	299	332	336

[A]Ref. 6 page 46.

The composite characteristics of the candidate characterized by the table of sources are: a male 19 to 29 years of age at time of commissioning capable of passing the standard physical, NAC, and OAR examination, with a C average or better in his college work. The table of commission sources shows a combination of high, low, and medium interest programs.

The high acquisition ratio shows that there should be no recruiting problems for the foreseeable future, barring more restrictive qualifications in the future.

3.2.13 Development of Acquisition Ratio (designator 410x, Chaplain Corps)

1.7 qualified applicants are required for each commission. 1.1 applicants are required for each qualified applicant. Screen for age is assumed to be 1.0 due to the wide age range allowed. Physical and NAC are .986 and .99, respectively.

The reciprocals for acquisition ratio for this program, 1975 to 1979, are .015, .015, .007, .011, and .011 respectively. This means that approximately 1 percent of the potential qualified candidates must become applicants satisfactorily to achieve the program goal.

The composite characteristics of the candidate characterized by the table of sources are: a male 19 to 39 years of age at time of commissioning capable of passing the standard physical and NAC examination. The table of commission sources shows high and low interest programs available.

The high acquisition ratio shows that there should be no recruiting problems for the foreseeable future. Suppose, however, that the CNO would want an estimate of the feasibility of insisting that chaplains entering the Navy possess a major in psychology. This model could be used to give a rapid approximation of the difficulties to be expected. First a random sample of 664 graduates of theological school would be checked to see how many possess a major in psychology.

This estimate is accurate to a precision of ±5 percent, with 99 percent confidence. Then by reducing supply by multiplying by the estimator for percent of psychology degrees, the acquisition ratio is reduced to a new value. This value can be used to assess the potential impact of the new ruling. Some numbers will now be made up to give an example of this procedure:

The acquisition ratio in 1976 is 68.58. Suppose the above experiment shows that the estimator of chaplains graduating with a major in psychology is .25 (one out of every four). The new acquisition ratio would be 17.15, which would be a good indication that the new restriction could be implemented. Conversely, if the estimator were .01, it would be obvious that this restriction could seriously impair the recruiting effort, since the acquisition ratio would then be less than 1.00.

TABLE 30

COMMISSION SOURCES
(designator 410x)

	Theology Student	Direct Appointment
Age (commission)	19-30	21-39
Physical	STD	STD
NAC	STD	STD
Special academic requirements	Accredited theological school	Various
OAR	No	No
Interest level	High	Low

TABLE 31

COMPUTATION OF ACQUISITION RATIO
(designator 410x, Chaplain Corps)

	1975	1976	FY 1977	1978	1979
Total graduates age 19-39	5,483[A]	5,567[A]	5,935[A]	6,293[A]	6,538[A]
Physical	4,913	4,988	5,318	5,639	5,858
NAC	4,864	4,938	5,265	5,582	5,799
Acquisition ratio	67.56	68.58	142.30	87.22	93.53
Applicants from current graduating class	72	72	37	64	62
Total applications required	80	80	41	71	69
Qualified applicants	73	73	37	65	63
Applicants selected	52	52	35	53	50
Selectees completing commissioning requirements	43	43	32	38	37

[A]Ref. 6 page 59.

3.2.14 Development of Acquisition Ratio (designator 510x, Civil Engineer Corps)

2 qualified applicants are required for each commission. 5 applicants are required for each qualified applicant. The Age, Physical, NAC, and OAR operators are .99, .896, .99, and .85, respectively. The unsubstantiated estimate for special academic requirement is .75. Having some estimate available allows the manipulation of the model to be carried out. Methods of obtaining more accurate estimates in the future are discussed in Chapter 2.

The reciprocals of acquisition ratio for this designator, 1975 to 1979, are .027, .037, .019, .024, and .023, respectively. This means that approximately 2 percent of the potential qualified candidates must become applicants satisfactorily to achieve the program goal. Some combinations of interest level and recruiter contact effectiveness which will achieve this goal for 1975 are shown below.

$(\text{acquisition ratio})^{-1}$	=	interest level	x recruiter effectiveness
.027	=	.027	1.000
.027	=	.164	.164
.027	=	1.000	.027

Thus if everyone eligible were interested in a Navy career, 3 percent of the population must be contacted by a recruiter. If 3 percent of the population is interested, then the entire population must be contacted. All other combinations lie between these two extremes.

The composite characterisitcs of the candidate characterized by the table of sources are: a male 21 to 34 years of age at time of commissioning, capable of passing the standard physical, NAC, and OAR examination, with better than a C average in one of the preferred fields eligible for the program. The table of commission sources shows a combination of high and low interest programs available.

The high acquisition ratio shows that there should be no recruiting problems for the foreseeable future, barring more restrictive qualifications in the future.

TABLE 32

COMMISSION SOURCES
(designator 510x)

	NROTC	ROC	Staff Corps	Direct Appointment	OCS (women)
Age (commission)	21-25	21-29	19-27½	21-34	20-27½
Physical	STD	STD	STD	STD	STD
NAC	STD	STD	STD	STD	STD
Special academic requirements	College board SAT	"C" average	preferred fields	preferred fields	degree
OAR	No	ROAT	Yes	Yes	Yes
Interest level	High	Low	Low	Low	Low

TABLE 33

COMPUTATION OF ACQUISITION RATIO
(designator 510x, CEC)

	FY 1975	1976	1977	1978	1979
Total graduates	55,433[A]	54,187[B]	51,868[B]	53,072[B]	53,952[B]
Age 21-34	54,879	48,066	46,009	47,077	47,858
Physical	49,171	47,585	45,549	46,606	47,379
NAC	48,680	35,689	34,162	34,955	35,534
OAR	31,033	30,336	29,037	29,711	30,204
Acquisition Ratio	37.57	26.82	52.51	42.08	43.58
Applicants from current graduating class	826	1,131	553	706	693
Total applications required	1,300	1,780	870	1,110	1,090
Qualified applicants	260	356	174	222	218
Applicants selected	195	271	128	161	160
Selectees completing commissioning requirements	130	178	87	111	109

[A]Ref. 8 page 96.

[B]Estimated using 1975 ratio engineering degrees to total degrees

4. DATA COLLECTION

4.1 What is Needed

> Public agencies are very keen on amassing statistics — they collect them, add them, raise them to the nth power, take the cube root and prepare wonderful diagrams. But what you must never forget is that every one of those figures comes in the first instance from the village watchman, who just puts down what he damn pleases.[8]

With those words, Sir Josiah Stamp accurately pinpointed a major difficulty in data analysis. The officer recruiting system is fortunate enough to have people who are much more dependable than Stamp's village watchman. Hand-picked officers of the highest calibre perform the officer recruiting task. Therefore, it stands to reason that, if these officers are given proper instructions concerning what information to gather and where to send it, they will comply.

A basic difficulty seems to be that individual candidates are tracked along in the system as long as they remain qualified. If a person fails qualification, he drops from the recruiter's list and is no longer kept track of, and therefore no accurate estimates are available to decision makers at year end for such items as total candidates contacted (by designator), total candidates disqualified due to NAC checks (by designator), and total candidates failing

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[8]Thomas H. Wonnacott and Ronald J Wonnacott, Introductory Statistics (New York: John Wiley and Sons, 1972), p. 397.

pre-screening aviation physicals conducted by recruiters. Failure to track these dropouts severely degrades the capability of the Navy to assess the actual recruiting climate. In the past, this has not been a problem due to factors such as the draft, a hostile economic climate in the civilian sector, and patriotic zeal of a large segment of the population. At the present time, officer recruiting still does not loom as a large problem. However, it can safely be said that the recruiting climate may very well get worse before it gets better, and a prudent decision would be to improve the data collecting in case accurate estimates are required in the future.

It is impractical to suggest specific details of how to set up the input for the computer at NAVCRUITCOM. It is sufficient to say that each recruiter should keep a tally of how many officer candidates he contacts, by designator or general category, and forward these results at some specified interval. Candidates who fail specific qualifications should be kept in the computer until annual computations can be made to obtain the operators discussed in this study such as NAC failures and physical failures. Sample surveys should be conducted periodically to double check estimates by hypothesis testing.

4.2 SAMPLE SIZE REQUIREMENTS

When analyzing dichotomous events (where a population is divided into two mutually exclusive and exhaustive

categories) an approach particularly easy to utilize is the binomial model. Let p be the proportion of individuals falling into one of the two categories, call it category A, and let all others fall into category B, since all outcomes not in A must fall in B. The proportion in category B is equal to 1-p. Hence, statistical inference about this population reduces to the study of the parameter p. This situation exists in this model for operators such as screen for age, screen physical, screen NAC, screen OAR, and screen for special academic requirements, since these are dichotomous events which lend themselves to the binomial.[9]

For a sample size n, say that event A occurs with frequency r and event B occurs with frequence n-r. From this tabulation, the maximum likelihood estimate, $\hat{p}$, of p is:

$$\hat{p} = \frac{r}{n}$$

Since large sample sizes are being used, it is safe to use the normal approximation to the binomial to complete this analysis. Therefore, the normal distribution may be used to calculate an approximate $100(1-\alpha)\%$ confidence interval for p. Thus we have

$$\hat{p} \pm z_{1-\frac{\alpha}{2}} \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

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[9]Discussion closely follows Ref. 1 page 37.

where $z_{1-\frac{\alpha}{2}}$ is the $100(1-\frac{\alpha}{2})$ percentile of a normal (0,1) distribution as a confidence level.

Specifically, if a two-sided 90 percent confidence interval is desired in the estimate (.05 in each tail) and the worst possible case is assumed (p = .5) a safe estimate for sample size can be computed. If p is not equal to .5, the required sample size will be reduced accordingly. Further assume $\alpha = .1$

$$z_{1-\frac{\alpha}{2}} \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = .05$$

to solve for n:

$$z_{1-\frac{.1}{2}} \sqrt{\frac{(\frac{1}{2})(\frac{1}{2})}{n}} = .05$$

$$z_{.95} \sqrt{\frac{1}{4n}} = .05$$

$$(2.576)^2 \frac{(20)^2}{4} = n$$

$$n = 664$$

Therefore, a sample size of 664 is sufficient to estimate a binomial parameter p to within a precision of plus or minus .05 with confidence that this estimate would be correct in 90 cases out of 100. Other precisions and other α levels can be utilized and required sample size can be computed accordingly.

5. SUMMARY AND RECOMMENDATIONS

A method of using operators to determine potential supply vs. expected demand for officer candidates is discussed. The ratio of supply to demand is used to discern various combinations of recruiter effectiveness and interest level of potential candidates which produce the desired goals. These ratios are not meaningful of themselves as the model is initially developed, but they become meaningful if they are continuously updated and reevaluated by a personnel expert, knowledgeable in statistical methods, and if they are correlated in the formative years with the degree of difficulty experienced by the Recruiting Command in achieving its goals. In this way, they become an index just as the Dow Jones Industrials are an index of stock market performance.

The following recommendations are made:

1. Establish an officer recruiting analyst billet for an 8510 P-coded officer. His task would be to improve estimates of operators described in this model, and to develop the model by statistical methods so that high reliability is achieved for acquisition ratios developed.

2. Establish the billet under both the U.S. Naval Recruiting Command and the Bureau of Naval Personnel to assure timely receipt of information needed from both organizations.

3. Choose an officer for this billet who possesses a background in personnel management, as well as statistics.

4. Encourage the Department of Health, Education, and Welfare to provide confidence intervals instead of point estimates in Reference 6, so that estimates of supply available can be used with greater confidence.

APPENDIX A

COMMISSIONS REQUIRED FY1975 TO FY1979

This appendix includes an estimate of accessions to active duty through FY1979. These estiamtes were developed in April and therefore are somewhat out of date already. The requirements as written for the out years have changed significantly since April. This will impact on the distribution of accessions. The fiscal year is changing from 30 June to 30 September commencing in 1976 so there is an interim period that will not belong to any fiscal year (1 Jul 76 to 1 Oct 76). The basic assumption applicable to the following figures is that the end strength for which these accessions were developed will be authorized by Congress and OSD. We know that this is incorrect but a necessary assumption for forecasting.

		FY75	FY76	FY77	FY78	FY79
URL						
11xx		2,160	1,617	978	1,744	1,687
*131x	(PTR)	1,037	1,080	1,250	1,250	1,250
139x	ACCESS	1,362	1,318	1,492	1,642	1,642
*132x	(NFOTR)	576	576	576	576	576
137x	ACCESS	756	656	656	756	756
RL						
14xx	EDO	21	17	18	18	10
15xx	AEDO	34	24	11	16	23
16xx	SD	78	58	53	74	75
17xx	EDO	0	0	0	0	0
18xx	SD	8	5	3	2	1
STAFF						
19xx	STUDENT	414	291	243	238	242
210x	MEDICAL	840	1,049	902	904	861
220x	DENTAL	423	566	401	410	398
230x	MSC	162	100	37	36	71
250x	JAG	45	34	37	39	51
290x	NC	268	343	445	516	504
310x	SC	380	279	299	332	336
370x	SC LDO				2	2
410x	CHC	43	43	22	38	37
510x	CEC	130	178	87	111	109
570x	CEC LDO				1	1
OTHER						
WO/LDO (INCL STAFF WO)		203	37	411	844	628
GRAND TOTAL		7,327	6,615	6,095	7,445	7,346

*If the PTR and NFOTR change due to requirements the number of 139x and 137x accessions change accordingly. The difference can then be programmed into another community.

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